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herent rights would entail disastrous consequences? Very possibly it would, and evils of this sort might have to be faced, but they would be in their nature temporary, and not nearly as disheartening as the lasting and deepening evils involved in the perpetuation of an administrative policy which is an affront to every professional instinct. Professor Joseph Jastrow, in a remarkably forceful and enlightened discussion of this subject in its bearings upon university administration (Science, April 13), puts the whole matter in a nutshell when he declares for the substitution of 'government by cooperation' for 'government by imposition.' This is surely the ideal toward which everyone having at heart the interests of education as a professional matter should strive, in fields both high and low, and we have observed numerous recent indications of a reaction in this sense from the military or corporate ideal which has hitherto had things its own way. But the enemy is still strongly intrenched, and his position will not easily be forced.—*The Dial.*

THE GEOLOGICAL SURVEY.

The National Geological Survey has properly taken alarm at the radical cut which Mr. Tawney, the new chairman of the House committee, has made in the appropriation for its work. He proposes to reduce the annual charge from $1,400,000 to $1,050,000, a cut which falls with especial severity upon certain of the survey's operations. The allowance for the measurement of streams for water-power purposes and to aid in settling other questions of municipal and domestic importance, in which New England is so vitally interested, has been cut from $200,000 to half that sum. The coal-testing plant at St. Louis, recently described in the *Transcript,* will be asked to get along on half rations. The division of mineral resources, and the Topographical Survey, have also felt the committee's pruning knife.

While it has long been evident that the Geological Survey was expanding far too rapidly, in common with various other functions of government, so radical a cut as this is neither necessary nor desirable. The survey has trained its own scientists for their various lines of work, and such a reduction as Mr. Tawney proposes would break up a corps that could not in years be reassembled. In view of the expenditures for war, like the $100,000,000 a year in time of profound peace, for the navy, it seems little short of ridiculous to be disturbed over a great civil establishment, whose work is counting for civilization and progress in a score of directions, at an annual cost which equals that of the navy for only four days. So long as the government can spend freely for some things, it seems unreasonable to hold other agencies down to the strict rules of economy. The survey is now moving vigorously to get the House or, if not that body, certainly the Senate, to restore its appropriation, in part, at least. Every new chairman of the appropriations committee makes a similar attempt. Mr. Cannon did, when he went into that service, and so did Mr. Hemenway, and now comes Mr. Tawney.

The national irrigation enterprise which is conducted by the Geological Survey, though not carried in its appropriations, is now at full tide. More ditch digging is probably in progress under its direction than at Panama, for the records show that the reclamation service is employing four thousand persons directly, and that the contractors working under it employ seven thousand more. Irrigation expenses have now reached one million dollars a month, paid for by the sales of public land, and at this rate expenditure will go on, it is safe to predict, for some years. These enterprises bring differing problems, and although no one of them is so difficult as that at Panama, they present in the aggregate questions to be solved, engineering, mechanical and financial, probably not less serious than at the Isthmus.—*The Boston Transcript.*

ASTRONOMICAL NOTES.

SUGGESTIONS FOR A THEORY OF THE MILKY WAY AND THE CLOUDS OF MAGELLAN.

Mr. Arthur R. Hinks, of Cambridge, England, has published an interesting pamphlet on 'Suggestion for a Theory of the Milky

Way and the Clouds of Magellan.' Mr. Hinks contends, and we think with good reason, that the facts do not support the Spencerian view, that the stars and nebulæ are so definitely separated that they must be regarded as complementary parts of a general scheme, a view which implies the symmetrical condensation of stars upon the plane of the Milky Way, and of nebulæ toward its poles. The author suggests as a working hypothesis, that the stars are distributed in a series of more or less independent star clouds about the plane of the Milky Way, and the nebulæ (not gaseous), in a series of nebula clouds out of the Milky Way, but not symmetrically condensed toward its poles. The Small Magellanic Cloud becomes by this plan a distant star cloud, and the Large Magellanic Cloud, a combined star and nebula cloud. The theory of Mr. Hinks certainly seems to satisfy recent investigations in distribution better than older and more rigid schemes.

THE MAGELLANIC CLOUDS.

FROM many standpoints the Magellanic Clouds are unique. To the naked eye they appear as detached portions of the Milky Way, faint luminous clouds which disappear in full moonlight. By no means, however, should they be regarded as merely irregular extensions of the Milky Way. They have some striking peculiarities. The Milky Way is characterized by enormous numbers of faint stars and the absence of small nebulæ in general, especially spirals. It has been shown by Professor Pickering that the Milky Way is probably composed entirely of faint stars of the first type, together with the greater part of the stars of the fifth type, which are numerically unimportant. The type of spectrum of the faint stars of the clouds has not been determined, but it is noteworthy that all fifth-type stars not found in the Milky Way are in the Magellanic Clouds. The Small Cloud resembles the Milky Way in the large numbers of faint stars and in the presence of numerous clusters. It also contains few nebulæ, but one of these is a bright-spiral. It is strikingly different from the Milky Way in the presence of great numbers of variable stars, nearly 1,000 having been found on the Harvard plates. The Large Cloud shows less resemblance to the Milky Way. It is true that there are great numbers of faint stars, but also there are great numbers of faint nebulæ. These nebulæ, however, do not appear to be spiral on the Harvard photographs. Variable stars are numerous. These clouds apparently contain within themselves all the different elements of our universe, and may well be imagined to constitute independent galaxies, if such exist.

THE SOLAR ORIGIN OF TERRESTRIAL MAGNETIC DISTURBANCES.

IT has been believed for a long time that terrestrial magnetic phenomena were more or less intimately associated with the sun, but Mr. E. Walter Maunder, of the Royal Observatory at Greenwich, has discovered a new phase of the problem which marks an epoch in this department of solar and terrestrial physics. He has shown conclusively that not only are magnetic disturbances related to the sun, but also that they are related to the sun's rotation. From a study of magnetic phenomena, extending from 1848 to 1903, including 726 disturbances, he has pointed out that whenever a magnetic disturbance occurred when a given heliographic longitude was at the center of the sun's apparent disc, there was a tendency for another disturbance to follow after one revolution of the sun brought again the same longitude to the center. So much seems sure. Certain conclusions, also, follow from these observations:

1. That the sun's action, of whatever nature, is not from the sun as a whole, but from restricted areas.

2. That the sun's action is not radiated, but restricted in direction.

PHOTOMETRIC DETERMINATION OF THE STELLAR MAGNITUDE OF THE SUN.

IN A. N. No. 4065, M. Ceraski, director of the Astronomical Observatory of Moscow, gives the results of a new determination of the stellar magnitude of the sun. The mean value obtained is -26.59. M. Ceraski, however, objects to the use of the term *minus* for

stars whose brightness is greater than that corresponding to magnitude zero, and suggests instead the word *supermagnitude*. The sun, therefore, becomes 26.59 supermagnitude. This value is based upon the Potsdam magnitudes of Polaris, Alpha Canis Min., and Sirius, which are 2.15, 0.56 and —1.09. The corresponding Harvard magnitudes are 2.12, 0.48 and —1.58, the use of which would, of course, have led to slightly different results. The sun sends us about seventeen billion times as much light as Sirius, the brightest star in the heavens.

RECENT AND COMING TOTAL ECLIPSES OF THE SUN.

THE total eclipse of August 30, 1889, was in many respects a favorable one. Skilled observers from various countries took up stations at so many widely separated places along the belt of totality, that the phenomenon could not well escape them all. Although clouds prevented observations in Labrador, elsewhere—in Spain, Algeria and Egypt—observations and photographs were obtained, which should increase substantially our knowledge of the sun, when the results have been reduced and compared.

Professor David P. Todd and Mr. R. H. Baker, of the Amherst Observatory, have issued a pamphlet, calling attention to the next favorable eclipse. Although there will be six total eclipses during the next six years, that of January 13–14, 1907, seems to be most favorable. This eclipse, however, presents some difficulties, since the track of totality lies in Turkestan and Mongolia. Nevertheless, it will doubtless be observed by some enthusiastic astronomers. The duration of totality will be about two minutes.

S. I. BAILEY.

FLUID LENSES.

A REPORT from Consul-General W. A. Rublee, at Vienna, states that after experiments extending over a number of years a Hungarian chemist has succeeded in producing optical lenses by a simple and cheap process that are not only quite as good as the best massive glass lenses at present used, but that can be manufactured of a size three times as great as the largest homogeneous glass lens heretofore made.

The importance of this invention in the field of astronomy is obviously very considerable. The largest glass lens heretofore manufactured out of massive glass for astronomical purposes has a diameter of about 1.50 meters, and it required several years to make it, while the price was several hundred thousands of marks. Such a lens can be manufactured by the new process in a few weeks at a cost of 2,000 or 3,000 marks. The price of a glass lens of the best German manufacture, with a diameter of 25 centimeters, is now about 7,000 marks, whereas the price of a similar lens made by the new process is about 150 marks. Lenses of smaller diameter for photographic purposes, for opera glasses, reading glasses, etc., can be produced at correspondingly smaller cost. The lens consists of a fluid substance inclosed between two unusually hard glass surfaces, similar to watch crystals, in which the refractive power and other characteristic properties are so chosen that the glass surfaces not only serve to hold the fluid, but also combine with the fluid to overcome such defects as are scarcely to be avoided in ordinary lenses. It is for this reason also that the lens is achromatic.

The fluid contained in the lens is hermetically closed, so that no air can enter and exercise a damaging effect. The fluid does not evaporate, and its composition is such that its properties are not affected by time or by temperature. The coefficient of expansion, both of the glass and of the fluid, is approximately the same between the temperatures of 15 degrees of cold and 60 degrees of heat. Another advantage of the lens is that, on account of the fact that the fluid is not dense and the glass crystals are thin, the whole lens combination through which the light must penetrate is very slight.

These fluid lenses are already manufactured in Austria, and are attracting attention both on account of their utility and the small price at which they are sold. Patents have been taken out in other countries, and they are soon to be introduced.